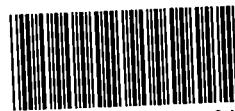


ESI



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EnviroSystems, Inc.



ENVIRONMENTAL TOXICOLOGY & CONSULTING

Original

**EVALUATION OF TOXICITY
OF SOIL SAMPLES TO THE
EARTHWORM, *Eisenia foetida*
MARCH 2000**

U.S. EPA Project 0002-L01

Prepared For

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By

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March 2000
Reference Number RFW 8505-00-03

STUDY NUMBER 8505**EXECUTIVE SUMMARY**

The following summarizes the results of chronic exposure bioassays during March 2000 on soil samples provided by Roy F. Weston, Incorporated of Delran, New Jersey. Soils were evaluated using the earthworm, *Eisenia foetida*.

Station Number	ESI Suffix	Exposure (Days)	Mean Survival (%)	Significantly Different from Laboratory Control - B?
Laboratory Control - A (Artificial Soil)	-	14	74.0	-
Laboratory Control - B (Organic Compost)	-	14	93.0	-
"SS-34"	-1	14	72.0	Yes
"SS-35"	-2	14	72.0	Yes
"SS-36"	-3	14	84.0	No
"SS-37"	-4	14	85.0	No
"BG-04"	-5	14	83.0	No

(b) (4)

Authorized Signature

EnviroSystems, Incorporated

3/31/2000
Date

**EVALUATION OF TOXICITY OF SOIL SAMPLES
TO THE EARTHWORM, *Eisenia foetida*
MARCH 2000**

U.S. EPA Project 0002-L01

1.0 INTRODUCTION

Toxicity tests expose groups of organisms to environmental samples and a laboratory control for a specified period to assess potential impact on survival and growth. The data are used to determine the relative toxicity of samples as compared to field reference sample sites.

This report presents the results of toxicity tests on five (5) soil samples provided by Roy F. Weston, Incorporated, Delran, New Jersey. Biological testing was based on programs and protocols developed by the US EPA (1989) and ASTM (1996). The toxicity of the samples was determined by conducting 14 day exposure assays with the earthworm, *Eisenia foetida*. All assays were performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

2.0 MATERIALS AND METHODS

2.1 General Methods, Biological Evaluations

Toxicological and analytical protocols used in this program follow procedures outlined in *Protocol for Short Term Toxicity Screening of Hazardous Waste Sites* (EPA 1989), *Aquatic Toxicology and Risk Assessment: Volume 11.05* (ASTM 1996) and *Standard Methods for the Examination of Water and Wastewater* (APHA 1991). These protocols provide standard approaches for physical and chemical analysis and for the evaluation of toxicological effects of soils to terrestrial organisms.

2.2 Test Species

Earthworms (*E. foetida*) were obtained from a single commercial supply source, Happy D Ranch Worm Farm, Visalia, California. Worms were maintained in composted soil. During culture and acclimation, worms were fed a commercially prepared ration identified as "Magic Worm Food." Temperature during culture was maintained at approximately 20°C. Worms used in the assay were adults with a well-developed clitellum.

2.3 Test Samples

A total of five (5) soil samples were received for testing on February 15, 2000. Samples were identified as "SS-34," "SS-35," "SS-36," "SS-37" and "BG-04." Samples were collected on February 14, 2000 and placed in 5 gallon plastic buckets. After the samples were received they were stored at 4°C in a secure sample storage area. Samples were warmed to the appropriate test temperature prior to testing.

2.4 *Eisenia foetida* Toxicological Evaluation Protocol

2.4.1 Sample Preparation

At the time of receipt all samples were visually inspected and the presence of "Free Water or standing water in the sample notes. Samples containing free water were air dried, at room temperature for 24 hours to reduce excess water, prior to further analysis. Prior to testing, moisture content, water holding capacity and pH were measured on each sample. Samples were then identified as to those that needed adjustments (drying or addition of water) to achieve a moisture content equal to approximately 70% of the soil's water holding capacity.

All samples were sieved through a 6-mm stainless steel screen to remove large stones, sticks, roots, and man-made material. Prior to placement in the test chambers, the moisture content of the sieved samples was adjusted, if necessary. At this time, the pH of the soil was adjusted if the pH of the sample was outside the range of 4 to 10 SU.

Two soils were used as laboratory controls in the earthworm assays. The first was an artificial soil prepared according to protocol developed by the EPA (1989). The soil consisted of (by dry weight) 10% screened sphagnum peat moss, 20% kaolinite clay and 70% fine silica sand. The silica sand was classified as 200 mesh. The peat moss was blended prior to use to break-up clods. After blending, the peat moss was screened to remove any large sticks and twigs. The moisture content of the soil was adjusted to approximately 30% using moderately hard reconstituted water. The pH of the soil was checked to insure values were within the range of 4 to 10 SU.

The second laboratory control soil was a commercially available organic compost. The compost, identified as "Coobscook Organic Compost and Planting Soil," is prepared by Coast of Maine, Incorporated of Portland, Maine. The product is described as being prepared from sphagnum peat moss, stone dust and seaweed. The compost has an organic content of 70.57%. The compost was used as a culture media for the *Eisenia* cultures.

2.4.2 Assay Protocol - 14 Day

The earthworm 14 day assay was conducted in a static exposure mode. Survival was the endpoint. The assay utilized 10 replicates with 10 worms per replicate. Approximately 200 g of soil were added to 600 mL glass jars. The jars were covered with lids in which a small hole, 1.6 mm diameter, had been placed to allow ventilation. Containers were placed in an incubator at 20 ±2°C. Lighting was set at 24 hours illumination. Light intensity was approximately 50 foot candles. During the exposure period incubator temperature was checked daily and monitored hourly using a data logger, for the duration of the assay. The worms were not fed during the assay. Daily observations were made concerning sublethal effects. After the counting on day 14 all worms were discarded.

2.5 Statistical Analysis

Survival and growth data were analyzed using TOXSTAT® software to determine potential significant differences between the treatment and background control. Data sets were evaluated to determine homogeneity of sample variances and normality. Data sets were normally distributed with homogeneous variances and were evaluated using parametric statistical models. Statistical differences were evaluated at $\alpha=0.05$. Results were noted as statistically different only when the results indicated a potential negative impact as compared to the Organic Compost control.

2.6 Reference Toxicant Evaluation

As part of the laboratory quality control program, reference toxicant evaluations were conducted with the test species used in the assay. These results provide relative health and response data while allowing for comparison with historic data sets. A cadmium chloride reference toxicant assay conducted on February 25, 2000 resulted in a 96 hour EC-50 of 8.24 mg/L (Binomial Method), as cadmium. This value was within two standard deviations of the historic mean for the species.

2.7 Protocol Deviations

Review of data associated with the conduct of the project identified no deviations from the study protocol. Review of data associated with the artificial soil laboratory control treatment suggest that the low pH, within the range specified by the ASTM and EPA protocols, in conjunction with the relatively organic content may have been responsible for the low survival. As survival in the culture media control exceeded minimum acceptability criteria the test organisms were deemed to be healthy and have had no impact on the outcome of the assay.

3.0 RESULTS AND DISCUSSION

Table 1 provides a summary of survival and growth data for the 14 day exposure period. Table 2 provides a summary of sample collection and receipt information. Percent moisture, water holding capacity and pH measurements are summarized in Table 3. Support data, including copies of laboratory bench sheets and statistical support, are included in Appendix A.

Temperatures monitored hourly in the test incubator during the 14 day exposure period ranged from 18.96 to 21.48°C with a mean value of 19.34°C. The standard deviation and variance for the data set were determined to be 0.178 and 0.032°C, respectively. The coefficient of variation was determined to be 0.9% during the 14 day period. The initial loading rate for the 14-day study was determined to be 13.5 g/Kg. This value was within the limit of 25 g/Kg specified by the method.

3.1 *Eisenia foetida* 14-Day Exposure Data

Review of the data at the end of the 14-day exposure period showed there was 74% survival in the artificial soil control and 93% survival in the organic compost laboratory control soil / culture media. Data from the organic compost control indicates that the test organisms were healthy and not impacted by handling.

Survival in both the "SS-34" soil and "SS-35" soil was 72.0%. Survival was 84% in "SS-36," 85% in "BG-04," and 83% in "SS-37." Review of the data showed that survival in samples "SS-34" and "SS-35" was significantly different from survival in the organic compost control. None of the samples were significantly different from the artificial soil control. Visual observation made during the counting showed no sublethal effects in any of the treatments.

3.2 Summary

Data collected after 14 days exposure showed that the "SS-34" and "SS-35" soil samples showed significant impact on the survival of the worms when compared to the organic compost control. Samples "SS-36," "SS-37" and "BG-04" showed no significant reduction in survival when compared to the organic compost control.

4.0 LITERATURE CITED

APHA. 1991. *Standard Methods for the Examination of Water and Wastewater*, 18th edition. Washington D.C.

ASTM. 1996. Annual Book of ASTM Standards. Volume 11.05. *Standard Guide for Conducting a Laboratory Soil Toxicity Test with the Lumbricid Earthworm Eisenia foetida*. Standard: E1676-95. ASTM, Philadelphia.

US EPA. 1989. *Protocol for Short Term Toxicity Screening of Hazardous Waste Sites*. EPA/600/3-88/029.

**TABLE 1. Summary of Earthworm (*Eisenia foetida*) Survival Data.
U.S. EPA Project 0002 - L01. March 2000.**

Station Number	ESI Suffix	Exposure (Days)	Mean Survival (%)	Coefficient of Variation (%)	Significantly Different from Laboratory Control - B?
Laboratory Control - A (Artificial Soil)	-	14	74.0	2.20	-
Laboratory Control - B (Culture Media / Compost)	-	14	93.0	0.84	-
"SS-34"	-1	14	72.0	1.21	Yes
"SS-35"	-2	14	72.0	1.84	Yes
"SS-36"	-3	14	84.0	1.21	No
"SS-37"	-4	14	85.0	1.32	No
"BG-04"	-5	14	83.0	1.62	No

Roy F. Weston, Incorporated, U.S. EPA Project 0002 -L01, March 2000.
ESI Study Number 8505.

**TABLE 2. Sample Collection and Receipt Summary.
U.S. EPA Project 0002 - L01. March 2000.**

Station Number	ESI Suffix	Collected		Received		Free Water on Receipt?
		Date	Time	Date	Time	
"SS-34"	-1	02/14/00	1110	02/15/00	0930	No
"SS-35"	-2	02/14/00	1120	02/15/00	0930	Yes*
"SS-36"	-3	02/14/00	1130	02/15/00	0930	Yes*
"SS-37"	-4	02/14/00	1200	02/15/00	0930	No
"BG-04"	-5	02/14/00	1145	02/15/00	0930	No

**TABLE 3. Summary of Physical and Chemical Characteristics.
U.S. EPA Project 0002 - L01. March 2000.**

Station Number	ESI Suffix	% Moisture	Holding Capacity (mL H ₂ O/100g)	Soil pH (SU)
Artificial Soil	-	1.95	60.6	5.00
Organic Compost	-	34.31	80.5	5.76
"SS-34"	-1	31.57	56.5	7.65
"SS-35"	-2	20.65	55.9	7.93
"SS-36"	-3	25.76	40.5	7.87
"SS-37"	-4	24.01	47.0	7.46
"BG-04"	-5	19.74	60.0	5.56

COMMENTS:

* Samples with "Free Water" on receipt were air dried before % Moisture was calculated.

Roy F. Weston, Incorporated, U.S. EPA Project 0002 -L01, March 2000.
ESI Study Number 8505.

**TABLE 4. Summary of Reference Toxicant Data.
U.S. EPA Project 0002 - L01. March 2000.**

Results are Expressed as mg/L Cadmium

Species	LC-50	Historic Mean	Number of Tests	±1 STD Deviation	±2 STD Deviations
<i>Eisenia foetida</i>	8.24	162.3	4	126.4	252.7

Original

APPENDIX A
RAW DATA - BIOASSAY SUPPORT

Eisenia foetida Acute Assay

STUDY NUMBER: 8505
 CLIENT: Roy F. Weston

DAY 0:

REP	CONTROLS				TEST SEDIMENTS									
	ARTIFICIAL SOIL		ORGANIC COMPOST		8505-1		8505-2		8505-3		8505-4		8505-5	
	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)
A	10	2.3	10	2.9	10	2.6	10	3.7	10	2.7	10	2.5	10	2.4
B	10	2.4	10	2.9	10	3.1	10	2.8	10	2.8	10	3.0	10	2.5
C	10	2.6	10	3.0	10	3.1	10	3.0	10	3.3	10	2.2	10	2.5
D	10	2.9	10	3.2	10	3.0	10	3.1	10	2.3	10	2.3	10	2.6
E	10	2.8	10	3.4	10	2.8	10	2.3	10	3.1	10	3.0	10	2.8
F	10	3.0	10	2.3	10	2.3	10	3.2	10	2.9	10	2.2	10	2.7
G	10	3.2	10	2.5	10	2.6	10	2.10	10	2.3	10	2.5	10	2.1
H	10	2.8	10	3.2	10	3.0	10	2.9	10	3.0	10	2.3	10	2.5
I	10	3.4	10	2.2	10	3.0	10	2.4	10	2.9	10	2.5	10	2.3
J	10	3.3	10	2.7	10	2.7	10	2.7	10	2.1	10	2.3	10	1.6
Initials	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	
Date	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	3/14/00	

NOTES: incub. temp 22°C at start

avg worm weight = 2.7 g per vessel

C:\My Documents\

Eisenia foetida Acute Assay

STUDY NUMBER: 8505
 CLIENT: Roy F. Weston

DAY 14:

REP	CONTROLS				TEST SEDIMENTS									
	ARTIFICIAL SOIL		ORGANIC COMPOST		8505-1		8505-2		8505-3		8505-4		8505-5	
	# Alive	Comments	# Alive	Comments	# Alive	Comments	# Alive	Comments	# Alive	Comments	# Alive	Comments	# Alive	Comments
A	10	3	9	3	9	3	8	3	7	3	8	5	10	3
B	4	2	8	3.4	7	3	7	3	9	3	9	5.3	10	3
C	6	3	10	3	6	3	8	3	10	3	9	5.3	7	3
D	8	3	9	3.4	6	3	10	3	9	3	9	5.3	10	3
E	8	2	9	3	7	3	8	3	8	3	10	5.3	7	3
F	9	1	10	3	7	3	6	3	8	5.3	9	5.3	9	3
G	6	1	10	3	7	3	7	3.4	8	3	7	5.3, 6	8	3
H	7	3	8	3	8	3	5	2	10	3	10	5.3	8	3
I	8	1	10	3	8	3	6	2	9	3	7	5.3	6	3
J	8	2	10	3	7	3	7	3	8	3	7	5.3	8	3
Initials	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)	(initials)
Date	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00	3/28/00

NOTES: 1 = lethargic

6 - odor

2 = soil very wet

3 = survivors very perky

4 = cocoons present

5 = seedlings present

Eisenia foetida Bioaccumulation Assay

STUDY NUMBER: 8505R

CLIENT: Roy F. Weston

On...
1/20/85

DAY	TEMP °C	INIT.	GENERAL OBSERVATIONS
0	22	xw	worms in, lights on
1	21	xw	Squirrel reading 19.5°C, lights + worms O.K.
2	22	xw	Squirrel reading 19.7°C, lights O.K. -4 has seedlings
3	21	xw	Squirrel reading 19.4°C, lights + worms O.K.
4	21	lW	Squirrel @ 19.6°C, lights + worms OK
5	21	cW	Squirrel @ 19.2°C, lights + worms OK
6	21	lW	Squirrel @ 19.3°C, lights + worms OK
7	21	z	Squirrel @ 19.5°C; lights + worms OK
8	21	lW	Squirrel @ 19.3°C; lights + worms OK
9		z	Squirrel @ 19.2°C; lights + worms OK
10	21	xw	Squirrel @ 19.4°C; lights + worms O.K.
11	21	BB	Squirrel @ 19.3°C lights + worms O.K.
12	21	lW	Squirrel @ 19.4°C lights + worms OK
13	21	lW	Squirrel @ 19.3°C lights + worms OK
14	21	xw	Squirrel @ 19.7°C, lights + worms, OK

Title: 8505 RFW E. FOETIDA SURVIVAL
 File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	6	0.6528	0.1088	4.0756
Within (Error)	63	1.6819	0.0267	
Total	69	2.3347		

(p-value = 0.0016)

Critical F = 3.1028 (alpha = 0.01, df = 6, 63)
 = 2.2464 (alpha = 0.05, df = 6, 63)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

Title: 8505 RFW E. FOETIDA SURVIVAL
 File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	COMPOST	1.3022	0.9300		
2	ARTIFICIAL	1.0538	0.7400	3.3992	*
3	SS-34	1.0191	0.7200	3.8733	*
4	SS-35	1.0264	0.7200	3.7731	*
5	SS-36	1.1733	0.8400	1.7634	
6	BG-04	1.1901	0.8500	1.5337	
7	SS-37	1.1675	0.8300	1.8429	

Dunnett critical value = 2.3400 (1 Tailed, alpha = 0.05, df [used] = 6, 60)
 (Actual df = 6, 63)

Title: 8505 RFW E. FOETIDA SURVIVAL
 File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	COMPOST	10			
2	ARTIFICIAL	10	0.1107	11.9	0.1900
3	SS-34	10	0.1107	11.9	0.2100
4	SS-35	10	0.1107	11.9	0.2100
5	SS-36	10	0.1107	11.9	0.0900
6	BG-04	10	0.1107	11.9	0.0800
7	SS-37	10	0.1107	11.9	0.1000

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	COMPOST	10	1.1071	1.4120	1.3022
2	ARTIFICIAL	10	0.6847	1.4120	1.0538
3	SS-34	10	0.8861	1.2490	1.0191
4	SS-35	10	0.7854	1.4120	1.0264
5	SS-36	10	0.9912	1.4120	1.1733
6	BG-04	10	0.9912	1.4120	1.1901
7	SS-37	10	0.8861	1.4120	1.1675

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	COMPOST	0.0161	0.1269	0.0401	9.7432
2	ARTIFICIAL	0.0416	0.2039	0.0645	19.3511
3	SS-34	0.0120	0.1094	0.0346	10.7326
4	SS-35	0.0299	0.1730	0.0547	16.8571
5	SS-36	0.0233	0.1525	0.0482	12.9975
6	BG-04	0.0264	0.1626	0.0514	13.6647
7	SS-37	0.0376	0.1939	0.0613	16.6073

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Chi-Square Test for Normality

Actual and Expected Frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	4.6900	16.9400	26.7400	16.9400	4.6900
OBSERVED	3	16	33	13	5

Chi-Square = 3.0635 (p-value = 0.5473)

Critical Chi-Square = 13.277 (alpha = 0.01, df = 4)
= 9.488 (alpha = 0.05, df = 4)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

***** Shapiro - Wilk's Test is aborted *****

This test can not be performed because total number of replicates is greater than 50.

Total number of replicates = 70

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 4.8004 (p-value = 0.5697)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

Title: 8505 RFW E. FOETIDA SURVIVAL
 File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	6	0.6528	0.1088	4.0756
Within (Error)	63	1.6819	0.0267	
Total	69	2.3347		
				(p-value = 0.0016)

Critical F = 3.1028 (alpha = 0.01, df = 6,63)
 = 2.2464 (alpha = 0.05, df = 6,63)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

Title: 8505 RFW E. FOETIDA SURVIVAL
 File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	artificial	1.0538	0.7400		
2	compost	1.3022	0.9300	-3.3992	
3	SS-34	1.0191	0.7200	0.4741	
4	SS-35	1.0264	0.7200	0.3739	
5	SS-36	1.1733	0.8400	-1.6359	
6	BG-04	1.1901	0.8500	-1.8655	
7	SS-37	1.1675	0.8300	-1.5564	

Dunnett critical value = 2.3400 (1 Tailed, alpha = 0.05, df [used] = 6,60)
 (Actual df = 6,63)

Title: 8505 RFW E. FOETIDA SURVIVAL
 File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	artificial	10			
2	compost	10	0.1589	21.0	-0.1900
3	SS-34	10	0.1589	21.0	0.0200
4	SS-35	10	0.1589	21.0	0.0200
5	SS-36	10	0.1589	21.0	-0.1000
6	BG-04	10	0.1589	21.0	-0.1100
7	SS-37	10	0.1589	21.0	-0.0900

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	artificial	10	0.6847	1.4120	1.0538
2	compost	10	1.1071	1.4120	1.3022
3	SS-34	10	0.8861	1.2490	1.0191
4	SS-35	10	0.7854	1.4120	1.0264
5	SS-36	10	0.9912	1.4120	1.1733
6	BG-04	10	0.9912	1.4120	1.1901
7	SS-37	10	0.8861	1.4120	1.1675

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	artificial	0.0416	0.2039	0.0645	19.3511
2	compost	0.0161	0.1269	0.0401	9.7432
3	SS-34	0.0120	0.1094	0.0346	10.7326
4	SS-35	0.0299	0.1730	0.0547	16.8571
5	SS-36	0.0233	0.1525	0.0482	12.9975
6	BG-04	0.0264	0.1626	0.0514	13.6647
7	SS-37	0.0376	0.1939	0.0613	16.6073

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Chi-Square Test for Normality

Actual and Expected Frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED OBSERVED	4.6900 3	16.9400 16	26.7400 33	16.9400 13	4.6900 5

Chi-Square = 3.0635 (p-value = 0.5473)

Critical Chi-Square = 13.277 (alpha = 0.01, df = 4)
= 9.488 (alpha = 0.05, df = 4)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

***** Shapiro - Wilk's Test is aborted *****

This test can not be performed because total number of replicates is greater than 50.

Total number of replicates = 70

Title: 8505 RFW E. FOETIDA SURVIVAL
File: 8505sv2 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 4.8004 (p-value = 0.5697)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

Channel 1 Statistics

Sample Period

Start 24-Feb-00 18:06:00. Finish 28-Mar-00 14:06:00.

Range : 0.000 to 30.000 degC

Minimum Value : 18.960 degC

at 13-Mar-00 07:06:00.

Maximum Value : 21.480 degC

at 24-Feb-00 18:06:00.

Mean : 19.343 degC

Standard Deviation : 0.178

Variance : 0.032

Channel Readings

Data file - 8505EF

Logger details:

Logger number : 10076
Logger type : 8-bit

Run details:

Site ID :
Run number : 1
Channels used : 1
Recording interval : 00:60:00.
Recording period :
 Start : 24-Feb-00 17:06:00.
 Finish : 29-Mar-00 14:06:00.
Readings per channel: 814

All readings

673	23-Mar-00 17:06:00.	19.320	748	26-Mar-00 20:06:00.	19.320
674	23-Mar-00 18:06:00.	19.320	749	26-Mar-00 21:06:00.	19.320
675	23-Mar-00 19:06:00.	19.320	750	26-Mar-00 22:06:00.	19.320
676	23-Mar-00 20:06:00.	19.320	751	26-Mar-00 23:06:00.	19.320
677	23-Mar-00 21:06:00.	19.320	752	27-Mar-00 00:06:00.	19.320
678	23-Mar-00 22:06:00.	19.320	753	27-Mar-00 01:06:00.	19.320
679	23-Mar-00 23:06:00.	19.320	754	27-Mar-00 02:06:00.	19.320
680	24-Mar-00 00:06:00.	19.320	755	27-Mar-00 03:06:00.	19.320
681	24-Mar-00 01:06:00.	19.320	756	27-Mar-00 04:06:00.	19.320
682	24-Mar-00 02:06:00.	19.200	757	27-Mar-00 05:06:00.	19.320
683	24-Mar-00 03:06:00.	19.200	758	27-Mar-00 06:06:00.	19.320
684	24-Mar-00 04:06:00.	19.200	759	27-Mar-00 07:06:00.	19.320
685	24-Mar-00 05:06:00.	19.200	760	27-Mar-00 08:06:00.	19.320
686	24-Mar-00 06:06:00.	19.200	761	27-Mar-00 09:06:00.	19.320
687	24-Mar-00 07:06:00.	19.200	762	27-Mar-00 10:06:00.	19.320
688	24-Mar-00 08:06:00.	19.200	763	27-Mar-00 11:06:00.	19.320
689	24-Mar-00 09:06:00.	19.200	764	27-Mar-00 12:06:00.	19.320
690	24-Mar-00 10:06:00.	19.200	765	27-Mar-00 13:06:00.	19.440
691	24-Mar-00 11:06:00.	19.320	766	27-Mar-00 14:06:00.	19.440
692	24-Mar-00 12:06:00.	19.320	767	27-Mar-00 15:06:00.	19.440
693	24-Mar-00 13:06:00.	19.320	768	27-Mar-00 16:06:00.	19.440
694	24-Mar-00 14:06:00.	19.320	769	27-Mar-00 17:06:00.	19.440
695	24-Mar-00 15:06:00.	19.320	770	27-Mar-00 18:06:00.	19.440
696	24-Mar-00 16:06:00.	19.320	771	27-Mar-00 19:06:00.	19.440
697	24-Mar-00 17:06:00.	19.320	772	27-Mar-00 20:06:00.	19.440
698	24-Mar-00 18:06:00.	19.320	773	27-Mar-00 21:06:00.	19.440
699	24-Mar-00 19:06:00.	19.320	774	27-Mar-00 22:06:00.	19.440
700	24-Mar-00 20:06:00.	19.320	775	27-Mar-00 23:06:00.	19.440
701	24-Mar-00 21:06:00.	19.320	776	28-Mar-00 00:06:00.	19.440
702	24-Mar-00 22:06:00.	19.320	777	28-Mar-00 01:06:00.	19.440
703	24-Mar-00 23:06:00.	19.320	778	28-Mar-00 02:06:00.	19.440
704	25-Mar-00 00:06:00.	19.320	779	28-Mar-00 03:06:00.	19.440
705	25-Mar-00 01:06:00.	19.320	780	28-Mar-00 04:06:00.	19.440
706	25-Mar-00 02:06:00.	19.200	781	28-Mar-00 05:06:00.	19.440
707	25-Mar-00 03:06:00.	19.200	782	28-Mar-00 06:06:00.	19.440
708	25-Mar-00 04:06:00.	19.200	783	28-Mar-00 07:06:00.	19.440
709	25-Mar-00 05:06:00.	19.200	784	28-Mar-00 08:06:00.	19.440
710	25-Mar-00 06:06:00.	19.200	785	28-Mar-00 09:06:00.	19.560
711	25-Mar-00 07:06:00.	19.200	786	28-Mar-00 10:06:00.	19.560
712	25-Mar-00 08:06:00.	19.200	787	28-Mar-00 11:06:00.	19.560
713	25-Mar-00 09:06:00.	19.200	788	28-Mar-00 12:06:00.	19.440
714	25-Mar-00 10:06:00.	19.320	789	28-Mar-00 13:06:00.	19.560
715	25-Mar-00 11:06:00.	19.320	790	28-Mar-00 14:06:00.	19.560
716	25-Mar-00 12:06:00.	19.320			
717	25-Mar-00 13:06:00.	19.440			
718	25-Mar-00 14:06:00.	19.440			
719	25-Mar-00 15:06:00.	19.440			
720	25-Mar-00 16:06:00.	19.440			
721	25-Mar-00 17:06:00.	19.440			
722	25-Mar-00 18:06:00.	19.440			
723	25-Mar-00 19:06:00.	19.440			
724	25-Mar-00 20:06:00.	19.440			
725	25-Mar-00 21:06:00.	19.440			
726	25-Mar-00 22:06:00.	19.440			
727	25-Mar-00 23:06:00.	19.440			
728	26-Mar-00 00:06:00.	19.440			
729	26-Mar-00 01:06:00.	19.440			
730	26-Mar-00 02:06:00.	19.440			
731	26-Mar-00 03:06:00.	19.440			
732	26-Mar-00 04:06:00.	19.440			
733	26-Mar-00 05:06:00.	19.440			
734	26-Mar-00 06:06:00.	19.440			
735	26-Mar-00 07:06:00.	19.440			
736	26-Mar-00 08:06:00.	19.440			
737	26-Mar-00 09:06:00.	19.440			
738	26-Mar-00 10:06:00.	19.440			
739	26-Mar-00 11:06:00.	19.440			
740	26-Mar-00 12:06:00.	19.440			
741	26-Mar-00 13:06:00.	19.440			
742	26-Mar-00 14:06:00.	19.440			
743	26-Mar-00 15:06:00.	19.440			
744	26-Mar-00 16:06:00.	19.320			
745	26-Mar-00 17:06:00.	19.440			
746	26-Mar-00 18:06:00.	19.320			
747	26-Mar-00 19:06:00.	19.320			

CHIQUITA

CLIENT: Roy F. Weston
ESI #: 8505 R
DATE: 3/15/00
INITIALS: KEB

pH MEASUREMENTS

SAMPLE ID	Beaker ID	pH VALUES in SU at START
CONTROL - Artificial Soil	42	5.00
-1	325	7.65
-2	202	7.93
-3	200	7.87
-4	199	7.646 <small>(3/15/00)</small> <small>X/22</small>
-5	322	5.56
Compost	41	5.76
-4 Duplicate	2	7.45

NOTES:

DOCUMENTATION FORM

STUDY No.: 8505 R STUDY DIRECTOR: _____

PROJECT TITLE: Roy F. Weston

GENERATED BY: KRB DATE: 3/13/00

The following information is

- Miscellaneous Documentation
- A Deviation from the Protocol
- A Deviation from SOP

<u>Sample ID.</u>	<u>Soil Wt. (g)</u>	<u>Water Vol. Calculated to Add (ml)</u>	<u>Water Vol. Added (ml)</u>
-1	2485.8	308 ml	150 ml
-2	3391.3 <small>(Large rocks may lower Vol. Needed)</small>	721 ml	300 ml
-3	3310.2	Not Needed	0 ml
-4	2500.9	281 ml	200 ml
-5	2174.7	549 ml	549 ml
Control	1618.5	703 ml	703 ml
Compost	1750.3	Between 3077 ml <small>↓ if WHC = Control's 761.2</small>	900 ml
		<small>Probably too High due to WHC being Run with old technique 3/13/00 7(EB)</small>	

-5 - Due to Low pH 10g 20g of Calcium Carbonate was added to Sample.

APPROVED BY: _____ DATE: _____

CONTINUATION

DOCUMENTATION FORM

STUDY No.: 8505 STUDY DIRECTOR: Ken Simon

PROJECT TITLE: Roy F. Weston - Initial Description of Samples

GENERATED BY: (b) (4) DATE: 2/16/00

The following information is

- Miscellaneous Documentation
 A Deviation from the Protocol
 A Deviation from SOP

Soil Content

-1- Good Dark Mud mixed well with clay. Moisture content Good.
Some Roots present.

-2- Standing water on top. Black muck with a lot of Large Rocks,
and chunks of glass. Rocks picked out by hand, dried on Counter

-3- Full of "Junk Yard" Hash. Rubber and Iron hose and/or Pipes, glass,
Iron chunks, and random unidentifiable items. Wire also present.
Mud was sifted through $\frac{1}{4}$ screen with about $\frac{1}{4}$ of sample
not passing through. When pH was taken about $\frac{1}{2}$ of sample
remained on the stir magnet when it was removed. Standing water.
Dried on Counter.

-4- Good dark mud, well mixed with sand, Moisture Content is
a little dry, may need a water adjustment.

-5- Soil mixed with clay in large chunks. Very dry, broken up
by hand and passed through $\frac{1}{4}$, ^{inch} Screen

APPROVED BY: _____ DATE: _____

CLIENT: Roy F. Weston
ESI #: 8505
DATE: 2/16/00 - 2/22/00
INITIALS: JCEJS

Pg. 1 of 2

TOTAL ORGANIC CARBON BY LOSS ON IGNITION

Sample ID	Crucible ID	Crucible Weight (g)	Crucible + Pre-Ignition Wt (g)	Crucible + Post-Ignition Wt (g)	Net Ignition Weight (g)	Total Loss on Ignition (g lost per g sample)
Control	I	25.2928	35.6474	34.5624	1.0850	0.1046
-1	II	27.8438	38.4524	37.5677	0.8847	0.0834
-2	III	25.9640	36.2888	35.5529	0.7359	0.0713
-3	IV	29.0167	49.4830	48.5989	0.8841	0.0432
-4	V	29.3315	39.8932	39.1072	0.7860	0.0744
BLK	VI	28.3723	38.6486	38.6475	0.0011	0.0001
Re-check	IV	29.0167	48.5989	48.6084	-0.0095	0.0005
Date & Initials	—	2/16/00 XCEJS	2/16/00 XCEJS	2/17/00 7CEJS ④ 2/22/00 XCEJS	2/17/00 7CEJS ④ 2/22/00 XCEJS	2/17/00 7CEJS ④ 2/22/00 XCEJS

COMMENTS: _____

Net Ignition Weight = (Crucible + Pre-Ignition Weight) - (Crucible + Post-Ignition Weight)

Total Loss on Ignition = Net Ignition Weight
 Soil Weight

Soil weight = (Crucible + Pre-Ignition Weight) - Crucible Weight

Artificial
Soil

Pg. 2 of 2

C:\...\

CLIENT: Roy F. Weston
 ESI #: 8505
 DATE: _____
 INITIALS: _____

TOTAL ORGANIC CARBON BY LOSS ON IGNITION

Sample ID	Crucible ID	Crucible Weight (g)	Crucible + Pre-Ignition Wt (g)	Crucible + Post-Ignition Wt (g)	Net Ignition Weight (g)	Total Loss on Ignition (g lost per g sample)
-4 Dup.	I	25.2737	35.3420	34.7756	0.5664	0.0563
-5	II	27.8438	37.8570	37.0961	0.7609	0.0760
BLK	VI	28.3773	38.6475	38.6467	0.0008	0.0001
Re-Check	II	27.8438	37.0961	37.0830	0.0131	0.0014
Date & Initials		2/17/00 XRB	2/17/00 2/27/00 XRB	2/22/00 XRB	2/23/00 XRB	2/23/00 XRB

COMMENTS: -4 Dup % Difference = 13.85%

Net Ignition Weight = (Crucible + Pre-Ignition Weight) - (Crucible + Post-Ignition Weight)

Total Loss on Ignition = Net Ignition Weight
Soil Weight

Soil weight = (Crucible + Pre-Ignition Weight) - Crucible Weight

CLIENT: Roy F. Weston
ESI #: 8505 R

REQUIRED SOIL HYDRATION

$$\text{Hydration Water To Be Added (mL/100g)} = \text{THW}_{ts} - \%M_{ts}$$

$$\text{THW}_{ts} = \text{PHYD} * \text{WHC}_{ts}$$

THW_{ts} = Total Soil Hydration Water Desired in mL/100g
 PHYD = Proportion of Hydration Required (0.75)
 WHC_{ts} = Water Holding Capacity of the Test Soil in mL/100g
 $\%M_{ts}$ = %Moisture of the Test Soil (% Moisture)

SAMPLE I.D.	PHYD	WHC _{ts} (mL/100g)	THW _{ts}	%M _{ts}	Water To Be Added: THW _{ts} - %M _{ts} (mL/100g)
Control	0.75	60.6	45.45	31.57 2.00 ^{2.55} 1.00 ^{1.00}	43.45
-1	0.75	56.5	42.38	31.57 use 29.98 ^{10.84} 12.40	
-2	0.75	55.9	41.92	20.65	21.27
-3	0.75	40.5	30.38	25.76	4.62 No Adjustment Needed
-4	0.75	47.0	35.25	24.01	11.24
-5	0.75	60.0	45.00	19.74	25.26
-1 Dup.	0.75	56.5	42.38	28.39	—

NOTES: -1 Avg. Dup. = 29.98 0.75% Dup. = 5.30% 3/13/00 XRD

Compost	0.75	247.7	185.78	103	125.78
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↑
Data from previous
test, 3/13/00 XRD

↑
Probably too High due to old
Technique.
3/13/00 XRD

CLIENT: Roy F. Weston
 ESI #: 8505

WATER HOLDING CAPACITY OF SOIL

$$\text{WHC (mL H}_2\text{O/100 g Soil)} = \frac{\text{Final wt (g) - Initial wt (g)}}{\text{Soil wt (g)}} \times 100$$

Initial wt (g) : Soil Dry Wt (g) + Wet Filter Paper + Funnel + Cup

Sample ID	Funnel ID	Soil Dry Wt (g)	Wet Filter Paper + Funnel + Cup (g)	Initial Wt (g)	Final Wt (g)	WHC (mL H ₂ O/100 g Soil)
Control	1	100.0	332.8	432.8	493.4	60.6
-1	2		165.5	265.5	322.0	56.5
-2	3		193.1	293.1	349.0	55.9
-3	4		60.3	160.3	200.8	40.5
-4	5		57.6	157.6	204.6	47.0
-5	6		60.2	160.2	220.2	60.0
-2 Dsp.	10	↓	57.4	157.4	205.5	48.1
Date & Initials	2/17/00 XKB	2/17/00 XKB	2/17/00 XKB	2/17/00 XKB	2/18/00 DAB	2/22/00 XKB

*2/22/00
XKB*
 NOTES ^(EII) Control mud will not drain in 4 hrs. so to keep times constant all soils were weighed after sitting over night. -1, -2, -3 were weighed for comparison at 3 hrs.

2/17/00	-1	323.2	57.7
XKB	-2	355.6	62.5
	-3	214.0	53.7

-2 Dsp. % Difference = 7.5%

Sample ID	Final Wt	WHC
		2/22/00 XKB

CLIENT: Roy F. Weston
ESI #: 8505R

SOIL DRYING PROCESS

Sample I.D.	Beaker I.D.	Dry Weight #1 (g)	Dry Weight #2 (g)	Dry Weight #3 (g)
Date & Initials				

COMMENTS: _____

PERCENT MOISTURE

Sample I.D.	Beaker I.D.	Beaker Wt. (g)	Soil Wet Wt.(g)	Dry Wt. #1 (g)	Dry Wt. #2 (g)	Dry Wt. #3 (g)	% Moisture
-1	10	28.8993	39.1658	35.9246	35.9248	—	31.57
-2	2	30.1658	40.3904	38.2785	38.2807	—	20.65
-3	30	29.9945	40.3159	37.6576	37.6574	—	25.76
-4	4E	29.1432	39.9189	37.3301	37.3338	—	24.01
-5	5E	29.0244	39.5616	37.4804	37.4827	—	19.74
Dup. -1	6A	28.9380	39.0042	36.1450	36.1478	—	28.39
Compost	Burst Guess	—	—	—	—	→	10%
Date & Initials		3/10/00 XRB	3/10/00 7CBB	3/13/00 XRB	3/13/00 XRB		3/13/00 7CBB

COMMENTS: Control has no change in SM, use old calculations.

$$(\text{Wet Wt.} - \text{Beaker Wt.}) - (\text{Dry Wt.} - \text{Beaker Wt.}) \times 100 = \% \text{ moisture}$$

(Wet Wt. - Beaker Wt.)

CLIENT: Roy F. Weston
 ESI #: 8505

OPENED

SOIL DRYING PROCESS

Sample I.D.	Beaker I.D.	Dry Weight #1 (g)	Dry Weight #2 (g)	Dry Weight #3 (g)
Control	15	73.279 A	73.2802 72.9186	—
-1	327	65.228	65.242	—
-2	353	59.525	59.529	—
-3	32	70.757	70.754	—
-4	112	62.1706	62.167	—
-5	192	68.936	68.919	—
Date & Initials	<u>2/16/00</u> <u>JCRD</u>	<u>2/16/00</u> <u>JCRD</u>	<u>2/16/00</u> <u>JCRD</u>	—

COMMENTS: _____

PERCENT MOISTURE

Sample I.D.	Beaker I.D.	Beaker Wt. (g)	Soil Wet Wt.(g)	Dry Wt. #1 (g)	Dry Wt. #2 (g)	Dry Wt. #3 (g)	% Moisture
Control	6A	28.9377	38.9379	38.7476	38.7375	—	1.95
-1	10	28.8991	38.3043	35.4448	35.4331	—	30.47
-2	1	28.6743	38.6527	36.3365	36.3279	—	23.26
-3	1E	29.1682	39.7200	36.9764	36.9693	—	26.03
-4	2C	28.4496	38.4455	36.2069	36.1970	—	22.44
-5	5E	29.0242	39.0821	37.0410	37.0321	—	20.34
Dup.-1	4E	29.1429	39.1690	36.0291	36.0180	—	31.37
Date & Initials	<u>2/17/00</u> <u>JCRD</u>	<u>2/17/00</u> <u>JCRD</u>	<u>2/17/00</u> <u>JCRD</u>	<u>2/22/00</u> <u>JCRD</u>	<u>2/22/00</u> <u>JCRD</u>		

COMMENTS: -1 Dup. % difference = 1.46%

$\frac{(\text{Wet Wt.} - \text{Beaker Wt.}) - (\text{Dry Wt.} - \text{Beaker Wt.})}{(\text{Wet Wt.} - \text{Beaker Wt.})} \times 100 = \% \text{ moisture}$

* Calculated % moisture of control used in assay starting 3/16/00. Other % moistures re-calculated.

***Eisenia foetida* Bioaccumulation Assay**
 WATER HOLDING CAPACITY & REQUIRED SOIL HYDRATION

Control Organic Compost

SAMPLE ID	FUNNEL I.D.	Soil Dry Wt (g)	Wet FP + Funnel + ₍₃₎	Initial Wt (g)	Final Wt (g)	WHC mL/100g	PHYD	WHC _{ts} (mL/100g)	THW _u	%M _u	Water To Be Added:
OC031400	1	100g	33.1	133.1 ₂	213.6	80.5	0.75	NA	6038	34.31	26 mL/100g

PERCENT MOISTURE Calculation

Sample I.D.	Beaker I.D.	Beaker Wt. (g)	Soil Wet Wt.(g)	Dry Wt. #1 (g)	Dry Wt. #2 (g)	Dry Wt. #3 (g)	% Moisture
OC031400	354	54.5090	64.8813	61.2538	61.2542	—	34.31

Eisenia foetida Acute Assay

STUDY NUMBER: 8505
 CLIENT: Roy F. Weston

DAY 0:

REP	CONTROL		8505-1		8505-2		8505-3		8505-4		8505-5	
	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)	# Added	Weight (g)
A	10	3.5	10	3.3	10	3.3	10	3.1	10	3.2	10	3.0
B	10	2.9	10	3.4	10	3.3	10	3.2	10	3.1	10	3.2
C	10	3.2	10	3.4	10	3.1	10	2.8	10	3.2	10	3.3
D	10	3.3	10	3.2	10	3.5	10	2.7	10	3.3	10	3.4
E	10	3.1	10	3.4	10	3.6	10	3.6	10	3.5	10	2.9
F	10	3.2	10	3.0	10	3.4	10	2.7	10	3.3	10	3.6
G	10	2.7	10	3.3	10	3.1	10	2.9	10	2.3	10	2.9
H	10	3.5	10	3.2	10	3.2	10	2.8	10	2.4	10	2.9
I	10	3.4	10	3.5	10	3.3	10	2.4	10	2.7	10	3.7
J	10	2.7	10	3.3	10	3.1	10	3.0	10	2.9	10	3.4
Initials	(initials)	(initials)	(initials)	(initials)	f	f	(initials)	(initials)	r	r	(initials)	(initials)
Date	2/24/00	2/24	2/24	2/24	2/24/00	2/24/00	2/24	2/24	2/24/00	2/24/00	2/24	2/24

NOTES:

Failed to Count Survival

Eisenia foetida Acute Assay

STUDY NUMBER: 8505
 CLIENT: Roy F. Weston

DAY 14:

REP	CONTROL		8505-1		8505-2		8505-3		8505-4		8505-5	
	# Alive	Comments										
A	7	3,4	3	3	7	3,5	10	3	4	6,2,5,3	10	3
B	8	3,4	6	3,5	9	3,4	10	3	7	3,5	9	3
C	10	3,4	6	3,5	7	3,5	10	3	7	5,3	7	3
D	5	3	6	3,5,4	7	2,3	10	1	8	5,2,3	9	3
E	10	3	6	3,4,5	6	3	7	3,4	5	5,6,2,3	10	3
F	10	3,4	8	3,4	4	1	7	3	8	5,2,3	7	3
G	8	3	8	3,4,5	4	2,1	7	1	6	5,3	8	3
H	9	3	7	3,5	7	2,3	9	3	9	5,2,3	8	3
I	7	3,4	8	3,5	5	1	6	3	8	5,3,2	10	3
J	6	3	7	3,5	5	3	7	3	7	5,2,3	8	3
Initials	(kw)	(kw)										
Date	3/9/01	3/9	3/9	3/9	3/9	3/9	3/9	3/9	3/9	3/9	3/9	3/9

NOTES: (1) = lethargic

(2) = soil very wet

(3) = survivors very picky

(4) = cocoons present

(5) = seedlings present

(6) = odor

Eisenia foetida Bioaccumulation Assay

STUDY NUMBER: 8505

CLIENT: Roy F. Weston

On Q.C. 1/19/91

DAY	TEMP °C	INIT.	GENERAL OBSERVATIONS
0	21	2L	Lights set for 24 hrs On; Squirrel Started.
1	21 20 ¹⁰ 21 ^{25.0}	2L	Squirrel reads 19.7 °C; Lights fine, No action in any rep.
2	21	CE	Squirrel reads 19.5 °C, Lights OK
3	21	WL	Squirrel reads 19.5 °C, lights OK, worm quiet
4	21	WL	Squirrel reads 19.5 °C, lights OK
5	21	WL	Squirrel reads 19.3 °C, lights + worms OK
6	21	KW	Squirrel reads 19.7 °C, worms + lights OK
7	21	WL	Squirrel reads 19.4 °C, worms + lights OK
8	21	KW	Squirrel reads 19.4 °C, worms + lights OK
9	21	CE	Squirrel reads 19.3 °C, worms + lights OK
10	21	WL	Squirrel reads 19.2 °C, worms + lights fine
11	21	KW	Squirrel reads 19.4 °C, lights + worms OK
12	21	BB	Squirrel reads 19.5 °C, lights + worms OK
13	21	KW	Squirrel reading 19.5 °C, light + worms OK
14	22	KW	Squirrel reading 19.6 °C, lights + worms OK.

Sediment 4 has many seedlings

DOCUMENTATION FORM

STUDY No.: 8505 STUDY DIRECTOR: _____

PROJECT TITLE: R FW

GENERATED BY: (b) (4) DATE: 2/22/00

The following information is



Miscellaneous Documentation



A Deviation from the Protocol



A Deviation from SOP

<u>Sample ID.</u>	<u>Sol Wt. (g)</u>	<u>Water Vol. Added(mL)</u>	<u>to Be Actually Water Vol. Added(mL)</u>
Control	1062g	462mL	462mL
-1	2202g	262mL	100 mL
-2	2190g	345mL	150mL
-3	2210g	Need no Adj.	—
-4	2210g	283mL	200mL
-5	2210g	545mL	475mL

Control 2nd Bag 602g 262mL 262mL

APPROVED BY: _____ DATE: _____

CLIENT: Roy F. Weston
 ESI #: 8505

ORIGINIAL

SOIL DRYING PROCESS

Sample I.D.	Beaker I.D.	Dry Weight #1 (g)	Dry Weight #2 (g)	Dry Weight #3 (g)
Control	15	73.2798	73.2802 72.9186	—
-1	327	65.228	65.242	—
-2	353	59.525	59.529	—
-3	32	70.757	70.754	—
-4	112	62.1706	62.167	—
-5	192	68.936	68.919	—
Date & Initials	2/16/00 JGB	2/16/00 XGB	2/16/00 JGB	—

COMMENTS: _____

PERCENT MOISTURE

Sample I.D.	Beaker I.D.	Beaker Wt. (g)	Soil Wet Wt.(g)	Dry Wt. #1 (g)	Dry Wt. #2 (g)	Dry Wt. #3 (g)	% Moisture
Control	6A	28.9377	38.9379	38.7476	38.7375	—	1.95 ←*
-1	1D	28.8991	38.3043	35.4448	35.4331	—	30.47
-2	1	28.6743	38.6527	36.3365	36.3279	—	23.26
-3	1E	29.1682	39.7200	36.9764	36.9693	—	26.03
-4	2C	28.4496	38.4455	36.2069	36.1970	—	22.44
-5	5E	29.0242	39.0821	37.0410	37.0321	—	20.34
Oup. -1	4E	29.1429	39.1690	36.0291	36.0180	—	31.37
Date & Initials	2/17/00 JGB	2/17/00 XGB	2/17/00 XGB	2/22/00 XGB	2/22/00 XGB	—	—

COMMENTS: -1 Oup. % Difference = 1.46%

$\frac{(\text{Wet Wt.} - \text{Beaker Wt.}) - (\text{Dry Wt.} - \text{Beaker Wt.})}{\text{Wet Wt.} - \text{Beaker Wt.}} \times 100 = \% \text{ moisture}$

$(\text{Wet Wt.} - \text{Beaker Wt.})$

* Calculated % moisture of control used in assay starting 3/16/00. Other % moistures re-calculated.

CLIENT: Roy F. Weston
ESI #: 8505

REQUIRED SOIL HYDRATION

Hydration Water To Be Added (mL/100g) = $\text{THW}_{ts} - \%M_{ts}$

$$\text{THW}_{ts} = \text{PHYD} * \text{WHC}_{ts}$$

THW_{ts} = Total Soil Hydration Water Desired in mL/100g
PHYD = Proportion of Hydration Required (0.75)
WHC_{ts} = Water Holding Capacity of the Test Soil in mL/100g
%M_{ts} = %Moisture of the Test Soil (% Moisture)

SAMPLE I.D.	PHYD	WHC _{ts} (mL/100g)	THW _{ts}	%M _{ts}	Water To Be Added: THW _{ts} - %M _{ts} (mL/100g)
Control	0.75	60.6	45.45	1.95	43.50
-1	0.75	56.5 57.7	42.38	30.47	11.91
-2	0.75	52.0	39.00	23.26	15.74
-3	0.75	40.5	30.38	26.03	4.35 Do Not Adjust.
-4	0.75	47.0	35.25	22.44	12.81
-5	0.75	60.0	45.00	20.34	24.66
Date + Initials	0.75	2/24/00 7:00	2/24/00 7:00	31.37	

2/24/00
NOTES: ~~(1)~~ all Dup. Results were Averaged since different samples were used
for Dup. in separate individual tests.

~~(2)~~ 2/24/00
7:00

If <10 no Adjustment Needed.

Oncology

CLIENT: Roy F. Weston
ESI #: 8505
DATE: 2/15/00
INITIALS: KRS

pH MEASUREMENTS

SAMPLE ID	Beaker ID	pH VALUES in SU at START
CONTROL - Artificial Soil	218	4.76
-1	26	7.87
-2	81	7.90
-3	92	7.93
-4	24	7.63
-5	60	3.83
-5 Duplicate	61	3.82

NOTES: -5 Needs to be brought up to 4 pH.
-5 = pH 4.01 meter so probe 21 2/13/00 KRS

LABORATORY SAMPLE RECEIVING LOG

Original

1. ESI Sample Number 8505 -1
2. Sponsor Name and Address Roy F. Weston Inc. (RFW)
5 Underwood Court
Delran, New Jersey 08075-1229
3. Sponsor Sample Identification According to Chain of Custody "TS-SS-34"
4. Sample Container Label Data 2/14/00 1110
5. Date Received 2/15/00 6. Time Received 0930
7. Method of Shipment/ Pick Up From RFW
Via Fed. Ex
8. Description of Shipping / Packing Containers(s) 1 5 gal plastic bucket
(Number, Type, Size)
9. Description of Sample Container(s) Same as above.
(Number, Type, Size)
10. Sample Storage Location and Required Storage Conditions Refrigerator "F"
Locked, 4°C & Dark
(b) (4)
11. Signature  Date 2/15/00
12. Notes
13. Date and Description of Final Sample Removal / Disposal

LABORATORY SAMPLE RECEIVING LOG

1. ESI Sample Number 8505 -2
2. Sponsor Name and Address Roy F. Weston Inc. (RFW)
5 Underwood Court
Delran, New Jersey 08075-1229
3. Sponsor Sample Identification According to Chain of Custody " TS - SS - 35 "
4. Sample Container Label Data 2/14/00 1120
5. Data Received 2/15/00 6. Time Received 0930
7. Method of Shipment/ Pick Up From RFW
Via Fed. Ex.
8. Description of Shipping / Packing Containers(s) 5gal plastic bucket (1)
(Number, Type, Size)
9. Description of Sample Container(s) same as above
(Number, Type, Size)
10. Sample Storage Location and Required Storage Conditions Refrigerator "F"
Locked, 4°C & Dark
11. Signature  (b) (4) Date 02/15/00
12. Notes _____

13. Date and Description of Final Sample Removal / Disposal _____

LABORATORY SAMPLE RECEIVING LOG

Original

1. ESI Sample Number 8505 -3
2. Sponsor Name and Address Roy F. Weston Inc. (RFW)
5 Underwood Court
Delran, New Jersey 08075-1229
3. Sponsor Sample Identification According to Chain of Custody "TS-SS-36"
4. Sample Container Label Data 2/14/00 1130
5. Data Received 2/15/00 6. Time Received 0930
7. Method of Shipment/ Pick Up From RFW
Via Fed. Ex.
8. Description of Shipping / Packing Containers(s) 1 - Small plastic bucket
(Number, Type, Size)
9. Description of Sample Container(s) Same as above
(Number, Type, Size)
10. Sample Storage Location and Required Storage Conditions Refrigerator "F"
Locked, 4°C & Dark
11. Signature (b) (4) Date 2/15/00
12. Notes
13. Date and Description of Final Sample Removal / Disposal

LABORATORY SAMPLE RECEIVING LOG

1. ESI Sample Number 8505-4
2. Sponsor Name and Address Roy F. Weston Inc. (RFW)
5 Underwood Court
Delran, New Jersey 08075-1229
3. Sponsor Sample Identification According to Chain of Custody "TS-SS-37"
4. Sample Container Label Data 214|00 1200
5. Data Received 2/15/00 6. Time Received 0930
7. Method of Shipment/ Pick Up From RFW
Via Fed Ex.
8. Description of Shipping / Packing Containers(s) 1 - 5 gal plastic bucket
(Number, Type, Size)
9. Description of Sample Container(s) same as above
(Number, Type, Size)
10. Sample Storage Location and Required Storage Conditions Refrigerator "F"
Locked, 4°C & Dark
11. Signature (b) (4) Date 2/15/00
12. Notes _____

13. Date and Description of Final Sample Removal / Disposal _____

Chromex

LABORATORY SAMPLE RECEIVING LOG

1. ESI Sample Number 8505 -5
2. Sponsor Name and Address Roy F. Weston Inc. (RFW)
5 Underwood Court
Delran, New Jersey 08075-1229
3. Sponsor Sample Identification According to Chain of Custody "TS-BG-04"
4. Sample Container Label Data 2/4/00 1145
5. Data Received 2/15/00 6. Time Received 0930
7. Method of Shipment/ Pick Up From RFW
Via Fed. Ex
8. Description of Shipping / Packing Containers(s) 5 gal plastic bucket -1
(Number, Type, Size)
9. Description of Sample Container(s) same as above
(Number, Type, Size)
10. Sample Storage Location and Required Storage Conditions Refrigerator "F"
Locked, 4°C & Dark
(b) (4)
11. Signature  Date 2/15/00
12. Notes 
13. Date and Description of Final Sample Removal / Disposal _____

Philadelphia, Pennsylvania 19107

CHAIN OF CUSTODY RECORD

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files